3 variable system Word Problems WS

1. Marina had $24,500 to invest. She divided the money into three different accounts. At the end of the year, she had made $1,300 in interest. The annual yield on each of the three accounts was 4%, 5.5%, and 6%. If the amount of money in the 4% account was four times the amount of money in the 5.5% account, how much had she placed in each account?

- Define variable:
  - x: 4%
  - y: 5.5%
  - z: 6%

- Write equations:
  - x + y + z = 24500
  - 0.04x + 0.055y + 0.06z = 1300
  - x - 4y + 0z = 0

- REWRITE as systems:
  - A = \begin{pmatrix} 1 & 1 & 1 \\ 0.04 & 0.055 & 0.06 \\ 1 & -4 & 0 \end{pmatrix}
  - B = \begin{pmatrix} 24500 \\ 1300 \\ 0 \end{pmatrix}

- Matrices:

$2000 was invested in the 1st account
$2000 was invested in the 2nd account
$14500 was invested in the 3rd account

2. Billy's Restaurant ordered 200 flowers for Mother's Day. They ordered carnations at $1.50 each, roses at $5.75 each, and daisies at $2.60 each. They ordered mostly carnations, and 20 fewer roses than daisies. The total order came to $599.50. How many of each type of flower was ordered?

- Define variable:
  - k: carnations
  - c: carnations
  - r: roses
  - d: daisies

- Write equations:
  - k + r + d = 200
  - 1.5c + 5.75r + 2.60d = 599.50
  - r = d - 20
  - k + r - d = 20

- REWRITE as systems:
  - A = \begin{pmatrix} 1 & 1 & 1 \\ 1.5 & 5.75 & 2.60 \\ 1 & -1 & -1 \end{pmatrix}
  - B = \begin{pmatrix} 200 \\ 599.50 \\ -20 \end{pmatrix}

- Matrices:

The Arcadium arcade in Lynchburg, Tennessee uses 3 different colored tokens for their game machines. For $20, you can purchase any of the following mixtures of tokens: 14 gold, 20 silver, and 24 bronze; or, 20 gold, 15 silver, and 19 bronze; or, 30 gold, 5 silver, and 13 bronze. What is the monetary value of each token?

- Define variable:
  - x: gold
  - y: silver
  - z: bronze

- Write equations:
  - 14x + 20y + 24z = 20
  - 20x + 15y + 19z = 20
  - 30x + 5y + 13z = 20

- REWRITE as systems:
  - A = \begin{pmatrix} 14 & 20 & 24 \\ 20 & 15 & 19 \\ 30 & 5 & 13 \end{pmatrix}
  - B = \begin{pmatrix} 20 \\ 20 \\ 20 \end{pmatrix}

- Matrices:

- .50 gold
- .35 silver
- .25 bronze

4. Last Tuesday, Regal Cinemas sold a total of 8500 movie tickets. Proceeds totaled $64,000. Tickets can be bought in one of 3 ways: a matinee admission costs $5, student admission is $6 all day, and regular admissions are $8.50. How many of each type of ticket was sold if twice as many student tickets were sold as matinee tickets?

- Define variable:
  - x: matinee
  - y: student
  - z: regular

- Write equations:
  - x + y + z = 8500
  - 5x + 6y + 8.5z = 64000
  - -2x + y + 0z = 0

- REWRITE as systems:
  - A = \begin{pmatrix} 1 & 1 & 1 \\ 5 & 6 & 8.5 \\ -2 & 1 & 0 \end{pmatrix}
  - B = \begin{pmatrix} 8500 \\ 64000 \\ 0 \end{pmatrix}

- Matrices:

900 matinee
1800 student
5800 regular
5. Annette, Barb, and Carlita work in a clothing shop. One day the three had combined sales of $1480. Annette sold $120 more than Barb. Barb and Carlita combined sold $280 more than Annette. How much did each person sell?

Define variable | write equations | REWRITE as systems | Matrices
---|---|---|---
A = Annette  
\( a + b + c = 1480 \)  
\( a + b + c = 1480 \)
B = Barb  
\( a = b + 120 \)  
\( a - b - c = 120 \)
C = Carlita  
\( b + c = a + 280 \)  
\( -a + b + c = 280 \)

\[
A = \begin{pmatrix}
1 & 1 & 1 \\
-1 & 0 & -1 \\
1 & 1 & 1
\end{pmatrix}
B = \begin{pmatrix}
1480 \\
120 \\
280
\end{pmatrix}
\]

Annette sold $600  
Barb $480  
Carlita $400

6. A triangle has one angle that measures 5° more than twice the smallest angle, and the largest angle measures 11° less than 3 times the measure of the smallest angle. Find the measures of the three angles.

Define variable | write equations | REWRITE as systems | Matrices
---|---|---|---
X = small  
\( x = 2y + 5 \)  
\( x + y + z = 180 \)
Y = middle  
\( y = 3x - 11 \)  
\( -2x + y + 2z = 5 \)
Z = large  
\( z = x + y + 2z = 180 \)  
\( -3x + 2y + z = -11 \)

\[
A = \begin{pmatrix}
1 & 1 & 1 \\
-2 & 1 & 0 \\
-3 & 0 & 1
\end{pmatrix}
B = \begin{pmatrix}
180 \\
5 \\
-11
\end{pmatrix}
\]

Small angle is 31°  
Middle angle 67°  
Large angle is 82°

7. Souvenir hats, T-shirts, and jackets are sold at a rock concert. Three hats, two T-shirts, and one jacket cost $140. Two hats, two T-shirts, and two jackets cost $170. One hat, three T-shirts, and two jackets cost $180. Find the prices of the individual items.

Define variable | write equations | REWRITE as systems | Matrices
---|---|---|---
H = hats  
\( 3h + 2t + j = 140 \)  
\( 2h + 2t + 2j = 170 \)
T = t-shirts  
\( h + 3t + 2j = 180 \)  
\( h + 3t + 2j = 180 \)
J = jackets  
\( 140 \)  
\( 170 \)

\[
A = \begin{pmatrix}
3 & 2 & 1 \\
2 & 2 & 2 \\
1 & 3 & 2
\end{pmatrix}
B = \begin{pmatrix}
140 \\
170 \\
180
\end{pmatrix}
\]

Hats = cost $15  
T-shirts cost $25  
Jackets cost $45

MAKE a MATRIX then solve the following systems with a calculator.

8. \[4x + 2y = 12 \]
\[-3x + 2y = 5 \]
\[-2x + y - 7z = 8 \]

\[
A = \begin{pmatrix}
4 & -3 & 2 \\
-3 & 2 & -3 \\
-2 & 1 & -7
\end{pmatrix}
B = \begin{pmatrix}
12 \\
5 \\
8
\end{pmatrix}
\]

\[
x = \frac{4}{1}  \quad y = -4  \quad z = -2
\]

9. \[3x + 2y + 2z = 11 \]
\[6x + 1y - 7z = 4 \]
\[1x - 6y + 10z = 1 \]

\[
A = \begin{pmatrix}
3 & 0 & 2 \\
0 & 1 & -7 \\
1 & -6 & 0
\end{pmatrix}
B = \begin{pmatrix}
11 \\
4 \\
1
\end{pmatrix}
\]

\[
x = 4  \quad y = \frac{12}{2}  \quad z = -\frac{1}{2}
\]